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20 April 2004

World Intellectual Property Organization  
PCT Division  
34 Chemin des Colombettes  
1211 GENEVA 20  
Switzerland

"Amendment of the claims under Article 19(1) (Rule 46)"

Re: International Application No. PCT/JP2003/016678  
Applicant: I.S.T CORPORATION  
Agent: IKEUCHI SATO & PARTNER PATENT ATTORNEYS  
International Filing Date: 25 December 2003  
Our Ref.: H1994-01

Dear Sir:

The Applicant, who received the International Search Report relating to the above-identified International Application transmitted on 2 March 2004, hereby files amendment under Article 19(1) as in the attached sheet.

That is, claims 1 and 8 are amended, and claims 2-7 and 9-16 are retained unchanged.

The applicant also files as attached herewith a brief statement explaining the amendment and indicating any Impact that amendment therein might have on the description and drawings.

Sincerely yours,

*Hiroyuki Ikeuchi*

IKEUCHI SATO & PARTNER PATENT ATTORNEYS  
Representative Partner  
Hiroyuki IKEUCHI

Attachment:

(1) Amendment under Article 19(1)	4 sheets
(2) Brief Statement	1 sheet

Explanation under the provision of PCT Article 19(1) (PCT regulations 46.4)

1. Explanation of Amendments

5 The amended parts of claim 1 are described on page 5 lines 6 to 12<sup>1</sup> of the Specification.

2. Comparison of the present Application with the Cited Documents

Even when all the Cited Documents are combined, the configuration of "wherein the polyimide precursor liquid composition  
10 further includes a cyclic compound that has a 5 member ring structure that includes a carbonyl group (C=O bond); wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms and does not include hetero atoms of nitrogen, phosphorous and sulfur" of claim 1 of the present application is not  
15 described or suggested.

Due to the aforementioned differences in the configuration, the present application has obtained the effect of "since compounds that have a five member ring-structure that includes a carbonyl group (C=O bond) have a larger dipole moment and dielectric constant than polar  
20 organic solvents that are generally used for polymerizing polyamic acid, and that these compounds strongly solvate with polyamic acid due to the planar structure derived from the five member ring, these compounds are substituted for the polar organic solvent when they are used, and there is an effect of preventing discoloration when firing at high  
25 temperatures." (page 5 lines 8 to 12<sup>2</sup> of the Specification).

Such characteristic actions and effects could not be predicted from the cited documents even by one skilled in the art.

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<sup>1</sup> Translators note: Corresponds to page 5 line 22 to page 6 line 10 of the English translation.

<sup>2</sup> Corresponds to page 6 lines 2 to 10 of the English translation.

3.     **Summary**

      We believe that the present application as described above has both novelty and inventive step.

## CLAIMS

1.(amended) A polyimide precursor liquid composition, comprising:

at least one type of tetracarboxylic dianhydride or derivative thereof;

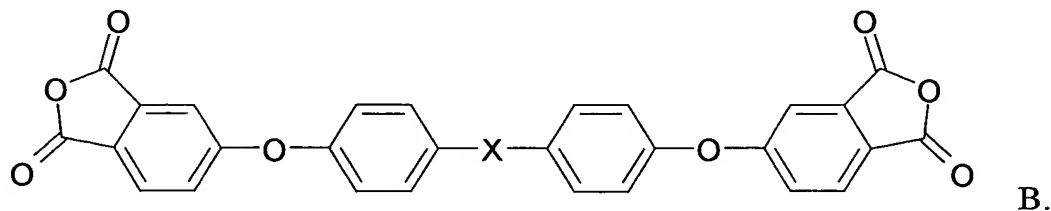
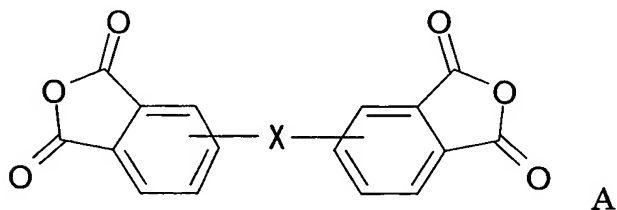
at least one type of diamine or derivative thereof; and  
a polar polymerization solvent;

wherein the polyimide precursor liquid composition further includes a cyclic compound that has a 5 member ring structure that includes a carbonyl group (C=O bond); and

wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms and does not include hetero atoms of nitrogen, phosphorous and sulfur.

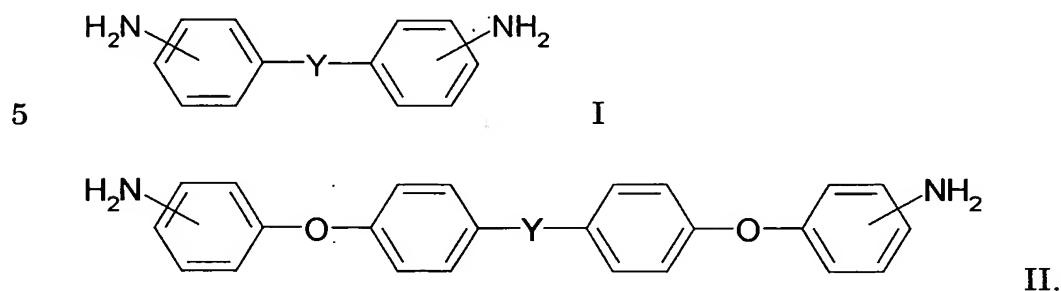
2. The polyimide precursor liquid according to claim 1,

wherein the tetracarboxylic dianhydride or derivative thereof is at least one type of compound selected from the group consisting of the following chemical formulae A and B (where X represents - O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond);



3. The polyimide precursor liquid composition according to claim 1,

wherein the diamine or derivative thereof is one type of compound selected from the group consisting of the following chemical formulae I and II (where Y represents  $-O-$ ,  $-S-$ ,  $-SO-$ ,  $-SO_2-$ ,  $-CH_2-$ ,  $-CF_2-$ ,  $-C(CH_3)_2-$ ,  $-C(CF_3)_2-$ ,  $-CO-$  or a direct bond);



4. The polyimide precursor liquid composition according to claim 1,  
 wherein the dielectric constant of the cyclic compound is not less  
 10 than 30.

5. The polyimide precursor liquid composition according to claim 1,  
 wherein the dipole moment of the cyclic compound is not less  
 than 3 debye.

15 6. The polyimide precursor liquid composition according to claim 1,  
 wherein when the solids portion of the polyimide precursor liquid  
 is 100 mass parts, the polar polymerization solvent is in the range of 150  
 to 900 mass parts, and the cyclic compound is in the range of 15 to 750  
 20 mass parts.

7. The polyimide precursor liquid composition according to claim 1,  
 wherein the polyimide precursor is polymerized in the polar  
 polymerization solvent, after which the cyclic compound is added.

25 8.(amended) A polyimide precursor liquid composition that has been

converted into an imide from a polyimide precursor liquid composition, the polyimide precursor liquid composition comprising:

at least one type of tetracarboxylic dianhydride or derivative thereof;

5 at least one type of diamine or derivative thereof; and  
a polar polymerization solvent;

wherein the polyimide precursor liquid composition further includes a cyclic compound that has a 5 member ring structure that includes a carbonyl group (C=O bond); and

10 wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms and does not include hetero atoms of nitrogen, phosphorous and sulfur.

9. The polyimide coating film according to claim 8,

15 wherein when the polyimide coating film is a film or coating film that has a thickness of  $50 \pm 10$  micrometers ( $\mu\text{m}$ ) and is irradiated with light of 420 nanometers (nm), the polyimide coating film shows a transmittance of 50% or more.

20 10. The polyimide coating film according to claim 8,  
wherein the glass transition temperature ( $T_g$ ) of the polyimide coating film is 200°C or more.

11. The polyimide coating film according to claim 8,

25 wherein the water absorption of the polyimide coating film is 2.0% or less.

12. The polyimide coating film according to claim 8,

30 wherein at least a single layer of a transparent, electrically conductive film is further formed on at least one side of the polyimide

coating film.

13. The polyimide coating film according to claim 12,  
wherein the electric resistance of the transparent, electrically  
5 conductive film is  $1 \times 10^{-2} \Omega\text{-cm}$  or less.

14. The polyimide coating film according to claim 8,  
wherein at least a single layer of a transparent film further is  
formed on at least one side of the polyimide coating film.

10

15. The polyimide coating film according to claim 14,  
wherein at least a single layer of a transparent, electrically  
conductive film is further formed on at least one side of the transparent  
film.

15

16. The polyimide coating film according to claim 15,  
wherein the electric resistance of the transparent, electrically  
conductive film is  $1 \times 10^{-2} \Omega\text{-cm}$  or less.

**WRITTEN AMENDMENTS**  
(Amended under the provision of Article 11)

5 JPO Examiner: Mr Yoshihiro Fuji

1. Display of International Application  
PCT/JP03/16678

10 2. Applicant

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25 4. Object of Amendment

Claims

Specification



## 5. Content of Amendment

(1) Page 3<sup>1</sup> of the Specification is replaced as in the appended documents.

(1-1) "... and wherein the cyclic compound ..." on page 3 lines 2 to 3<sup>2</sup> is amended to "... wherein the cyclic compound ... wherein the tetracarboxylic dianhydride or derivative thereof includes the chemical formula B described below (where X represents - O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond)."

(1-2) "...at least one type of aromatic tetracarboxylic dianhydride or derivative thereof selected from the group consisting of the following chemical formulae A and B (where X represents - O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond)" on page 3 line 23<sup>3</sup> is amended to "...an aromatic tetracarboxylic dianhydride or derivative thereof, which is made from a mixture of the chemical formulae A and B (where X represents - O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond), and in which the mixing ratio is in a range, in terms of mole ratio, of chemical formula A : chemical formula B = 1:9 to 5:5."

(2) Pages 20 to 22<sup>4</sup> of the Specification are replaced as in the appended documents.

(2-1) "Working Example 16" on page 20 line 4<sup>5</sup> is amended to "Working Example 16, Reference Example", and "Working Example 17" on page 20 line 10<sup>6</sup> is amended to "Working 17, Reference Example".

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<sup>1</sup> Translator's note: Corresponds to pages 3 and 4 of the English translation.

<sup>2</sup> Corresponds to page 3 lines 17 to 19 of the English translation.

<sup>3</sup> Corresponds to page 4 lines 12 to 16 of the English translation.

<sup>4</sup> Corresponds to pages 22 to 25 of the English translation.

<sup>5</sup> Corresponds to page 22 line 15 of the English translation.

<sup>6</sup> Corresponds to page 22 line 24 of the English translation.

(2-2) "Diamine component (molar ratio \*1)" and "Acidic anhydride component (molar ratio \*1)" in Table 5 on page 21<sup>7</sup> were swapped about respectively, so are displayed correctly.

(2-3) " Working Example 16" in Table 5 on page 21<sup>8</sup> and in Table 6 on page 22<sup>9</sup> are amended to "Working Example 16, Reference Example", and " Working Example 17" in Table 5 on page 21<sup>10</sup> and in Table 6 on page 22<sup>11</sup> respectively is amended to "Working Example 17, Reference Example".

(3) Pages 24 to 27<sup>12</sup>, being the Claims in their entirety, are replaced as in the appended documents.

(3-1) " ..., and wherein the cyclic compound ..." in claim 1 (page 24 line 10<sup>13</sup>) is amended to " ..., wherein the cyclic compound ... and wherein the tetracarboxylic dianhydride or derivative thereof includes the chemical formula B described below (where X represents - O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond)." and chemical formula B is added.

(3-2) "wherein the tetracarboxylic dianhydride ... or a direct bond)." in claim 2 (page 24 lines 13 to 15<sup>14</sup>) is amended to "wherein the tetracarboxylic dianhydride or derivative thereof further comprises the following chemical formula A (where X represents - O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond), and

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<sup>7</sup> Corresponds to page 24 of the English translation.

<sup>8</sup> Corresponds to page 24 of the English translation.

<sup>9</sup> Corresponds to page 25 of the English translation.

<sup>10</sup> Corresponds to page 24 of the English translation.

<sup>11</sup> Corresponds to page 25 of the English translation.

<sup>12</sup> Corresponds to pages 28 to 31 of the English translation.

<sup>13</sup> Corresponds to page 28 lines 11 and 12 of the English translation of the Article 19 amendments.

<sup>14</sup> Corresponds to page 28 lines 16 to 20 of the English translation of the Article 19 amendments.

the mixing ratio thereof is in a range, in terms of mole ratio, of chemical formula A : chemical formula B = 1:9 to 5:5", and chemical formula B in claim 2 is removed.

(3-3) "A polyimide precursor liquid composition that has been converted  
5 into an imide from a polyimide precursor liquid composition," in claim 8 (page 26 line 2<sup>15</sup>) is amended to "A polyimide coating film that is obtained by converting a polyimide precursor liquid composition into an imide,".

(3-4) "; and

10            wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms." in claim 8 (page 26 line 6<sup>16</sup>) is amended to ";

             wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms; and

15            wherein the tetracarboxylic dianhydride or derivative thereof includes a chemical formula B described below (where X represents – O –, – S –, – SO –, – SO<sub>2</sub> –, – CH<sub>2</sub> –, – CF<sub>2</sub> –, – C(CH<sub>3</sub>)<sub>2</sub> –, – C(CF<sub>3</sub>)<sub>2</sub> – or a direct bond);", and chemical formula B is removed.

(3-5) Claim 17 is added.

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<sup>15</sup> Corresponds to page 29 line 26 to page 30 line 1 of the English translation of the Article 19 amendments.

<sup>16</sup> Corresponds to page 30 lines 10 to 11 of the English translation of the Article 19 amendments.

6. Index of attached documents

- (1) Pages 3 and 3/1 and pages 20 to 22/1<sup>17</sup> of the Specification
- (2) Pages 24 to 27<sup>18</sup> of the Claims

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<sup>17</sup> Corresponds to pages 3 and 4, and pages 22 to 25 of the English translation.

<sup>18</sup> Corresponds to pages 28 to 31 of the English translation of the Article 19 amendments.

Patent Reference 2: JP 2000-313804A.

However, in recent years, polyimides having even greater transparency have been demanded, in imaging devices using liquid crystal elements or electroluminescence (EL), for example, in optic fibers, optic wave guides, and electrical components such as protective coating films for solar cells and printed boards.

#### Disclosure of Invention

The present invention improves on the conventional art, and provides a polyimide coating film that has even higher transparency, and a polyimide precursor liquid that is used in the polyimide coating film thereof.

A polyimide precursor liquid composition of the present invention includes, at least one type of tetracarboxylic dianhydride or derivative thereof, at least one type of diamine or derivative thereof, and a polar polymerization solvent, wherein the polyimide precursor liquid composition further includes a cyclic compound, wherein the cyclic compound has a boiling point of 200°C or more and includes carbon, hydrogen and oxygen atoms, and wherein the tetracarboxylic dianhydride or derivative thereof includes the chemical formula B described below (where X represents  $-O-$ ,  $-S-$ ,  $-SO-$ ,  $-SO_2-$ ,  $-CH_2-$ ,  $-CF_2-$ ,  $-C(CH_3)_2-$ ,  $-C(CF_3)_2-$  or a direct bond).

The polyimide coating film of the present invention is obtained by converting the polyimide precursor liquid composition to an imide.

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#### Brief Description of Drawings

FIG. 1 is the thermal analysis data of BPADA used in Working Examples 1 to 7 of the present invention, as measured by a differential scanning calorimeter (DSC).

30 FIG. 2 is an O1s spectrograph obtained by XPS analysis of a

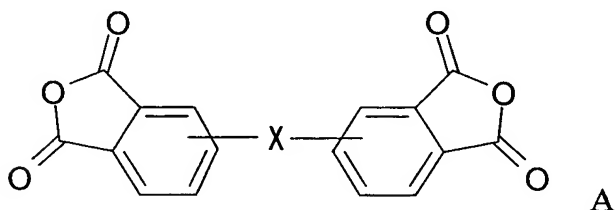
polyimide obtained in Working Example 1 of the present invention.

FIG. 3 is an O1s spectrograph obtained by XPS analysis of a polyimide obtained in Comparative Example 1.

## 5 Best Mode for Carrying Out the Invention

The present invention can provide a polyimide coating film that has even higher transparency than one made by the conventional art by providing a polyimide precursor liquid composition that includes at least one type of tetracarboxylic dianhydride or derivative thereof, at least one  
 10 type of diamine or derivative thereof, and a polar polymerization solvent, wherein the polyimide precursor liquid composition further includes a cyclic compound, and wherein the cyclic compound has a boiling point of 200°C or more, and includes carbon, hydrogen and oxygen atoms.

Preferable raw material compositions that can be used in the  
 15 present invention are cyclic compounds that include: an aromatic tetracarboxylic dianhydride or derivative thereof, which is made from a mixture of the chemical formulae A and B (where X represents  $-O-$ ,  $-S-$ ,  $-SO-$ ,  $-SO_2-$ ,  $-CH_2-$ ,  $-CF_2-$ ,  $-C(CH_3)_2-$ ,  $-C(CF_3)_2-$  or a direct bond), and in which the mixing ratio is in a range, in terms of mole ratio,  
 20 of chemical formula A : chemical formula B = 1:9 to 5:5; and a polar polymerization solvent; wherein the cyclic compound has a boiling point of 200°C or more and includes carbon, hydrogen and oxygen atoms.



conversion reaction and to cure the film. Then, the glass plate was removed from the oven, cooled to room temperature and the film separated from the glass plate. The light transmittance and water absorption ratio of the polyimide film then were measured. These results are shown in Table 5 and 6.

*Working Examples 8 to 15*

Apart from changing the molar ratio of the diamine or the bifunctional acid anhydride as noted in Tables 5 and 6, the polyimide precursor liquids and polyimide films were fabricated in the same way as in Working Example 7, and the light transmittance, toughness and glass transition temperature of the polyimide films were measured. Those results are noted in Tables 5 and 6.

*Working Example 16, Reference Example*

Apart from changing the diamine to 4,4-DDA / NBDA at the mole ratios noted in Tables 5 and 6, and changing the bifunctional acid anhydride to BPDA only, the polyimide precursor liquid and the polyimide film were fabricated in the same way as in Working Example 7, and the light transmittance, toughness and glass transition temperatures were measured. These results are noted in Tables 5 and 6.

*Working Example 17, Reference Example*

(a) Synthesis of the polyimide precursor (polyamic acid) liquid

An agitator on which a polytetrafluoroethylene agitating impeller is attached, and a nitrogen gas insertion pipe were attached to a 500 ml three-necked flask to make a polymerization vessel, and all reactions were performed under a nitrogen atmosphere. 28.317 g (0.184 mol) of NBDA was added as the diamine component, and 216.0 g of DMAC was

added as the polymerization solvent, such that the solids composition of the polyimide precursor liquid was 28 mass%. After stirring thoroughly, 55.683 g (0.189 mol) of BPDA was dosed as-is in solid form over 5 min as the bifunctional acid anhydride at 1.03 times the molar ratio with  
5 respect to the diamine. 15 minutes later, the reaction solution had turned to a yoghurt-type consistency. The reaction temperature then rose rapidly to about 60°C, and the solution changed from a yoghurt-type consistency to a viscous liquid. The precursor liquid was obtained by further reacting for 12 hours at 40°C. Next, 36.0 g of  $\gamma$ -butyrolactone  
10 was added such that when the solids portion of the polyimide precursor liquid was set to 100 mass parts, the cyclic compound was 43 mass parts. The polyimide film was fabricated in the same way as Working Example 7, and the light transmittance, toughness and glass transition temperature of the polyimide film were measured. The results are  
15 shown in Tables 5 and 6.



Table 5

	Monomer		Additive (mass parts)
	Diamine component (molar ratio)	Acid anhydride component (molar ratio)	
Working Example 7	4,4-DDS(100)	BPDA/BPADA(90/10)	$\gamma$ -butyrolactone (214)
Working Example 8	4,4-DDS(100)	BPDA/BPADA(80/20)	$\gamma$ -butyrolactone (214)
Working Example 9	4,4-DDS(100)	BPDA/BPADA(70/30)	$\gamma$ -butyrolactone (214)
Working Example 10	4,4-DDS(100)	BPDA/BPADA(60/40)	$\gamma$ -butyrolactone (214)
Working Example 11	4,4-DDS(100)	BPDA/BPADA(50/50)	$\gamma$ -butyrolactone (214)
Working Example 12	4,4-DDS(100)	BPDA/BPADA(70/30)	$\gamma$ -butyrolactone (43)
Working Example 13	4,4-DDS(100)	BPDA/BPADA(70/30)	$\gamma$ -butyrolactone (143)
Working Example 14	4,4-DDS(100)	BPDA/BPADA(70/30)	$\gamma$ -butyrolactone (214)
Working Example 15	3,3-DDS(100)	BPDA/BPADA(75/25)	$\gamma$ -butyrolactone (42)
Working Example 16, Reference Example	4,4-DDS/NBDA (70/30)	BPDA(100)	$\gamma$ -butyrolactone (43)
Working Example 17, Reference Example	NBDA(100)	BPDA(100)	$\gamma$ -butyrolactone (43)
Comparative Example 9	4,4-DDS(100)	BPDA/BPADA(90/10)	.
Comparative Example 10	4,4-DDS(100)	BPDA/BPADA(80/20)	.
Comparative Example 11	4,4-DDS(100)	BPDA/BPADA(70/30)	.
Comparative Example 12	4,4-DDS(100)	BPDA/BPADA(60/40)	.
Comparative Example 13	4,4-DDS(100)	BPDA/BPADA(50/50)	.
Comparative Example 14	4,4-DDS(100)	BPDA/BPADA(70/30)	Tetrahydrofuran (214)
Comparative Example 15	4,4-DDS(100)	BPDA/BPADA(70/30)	Butyl cellosolve (214)
Comparative Example 16	4,4-DDS(100)	BPDA/BPADA(70/30)	Isophorone (214)
Comparative Example 17	3,3-DDS(100)	BPDA/BPADA(75/25)	.
Comparative Example 18	4,4-DDS/NBDA (70/30)	BPDA(100)	.
Comparative Example 19	NBDA(100)	BPDA(100)	.

Remarks: The values within the brackets in the Additives column indicate the number of mass parts of the additive when the polyimide precursor (solids portion) is 100 mass parts.

	Film Thickness ( $\mu\text{m}$ )	Light Transmittance (%)	Toughness	Glass transition temperature ( $^{\circ}\text{C}$ )
Working Example 7	52	73.2	P	338
Working Example 8	49	72.4	P	316
Working Example 9	53	76.3	P	304
Working Example 10	51	74.7	P	287
Working Example 11	48	73.5	P	270
Working Example 12	48	72.8	P	304
Working Example 13	54	75.2	P	304
Working Example 14	56	71.9	P	304
Working Example 15	49	76.7	P	250
Working Example 16, Reference Example	51	68.7	P	315
Working Example 17, Reference Example	52	66.4	P	239
Comparative Example 9	52	67.8	P	338
Comparative Example 10	49	68.7	P	316
Comparative Example 11	53	67.0	P	304
Comparative Example 12	51	66.1	P	287
Comparative Example 13	48	69.8	P	270
Comparative Example 14	57	65.8	P	304
Comparative Example 15	53	62.7	P	304
Comparative Example 16	57	0.2	F	-
Comparative Example 17	50	72.5	P	250
Comparative Example 18	48	67.7	P	315
Comparative Example 19	52	65.8	P	239

In Tables 5 and 6, the results of Working Examples 1 to 8 are within the range of the present invention, and thus transparency and toughness were high. In comparison, since lactone compounds were not added to comparative examples 9 to 19, their transparency was lower than that of the products of the working examples

*Working Example 18*

## CLAIMS

1.(amended) A polyimide precursor liquid composition, comprising:

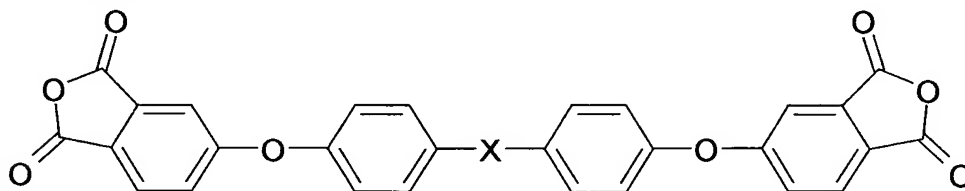
at least one type of tetracarboxylic dianhydride or derivative thereof;

at least one type of diamine or derivative thereof; and  
a polar polymerization solvent;

wherein the polyimide precursor liquid composition further includes a cyclic compound that has a 5 member ring structure that includes a carbonyl group (C=O bond);

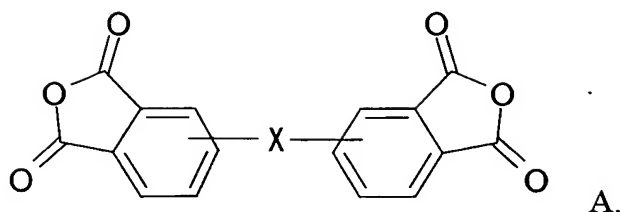
wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms and does not include hetero atoms of nitrogen, phosphorous and sulfur; and

wherein the tetracarboxylic dianhydride or derivative thereof includes the chemical formula B described below (where X represents – O –, – S –, – SO –, – SO<sub>2</sub> –, – CH<sub>2</sub> –, – CF<sub>2</sub> –, – C(CH<sub>3</sub>)<sub>2</sub> –, – C(CF<sub>3</sub>)<sub>2</sub> – or a direct bond);

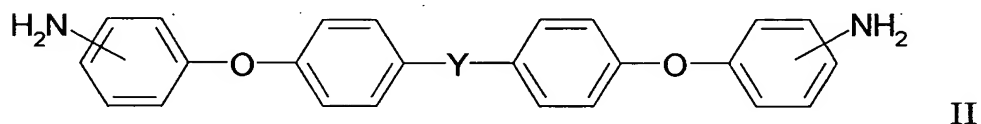
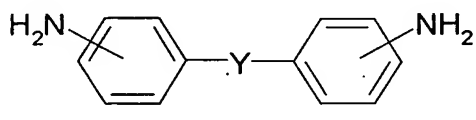


20 2.(amended) The polyimide precursor liquid according to claim 1,

wherein the tetracarboxylic dianhydride or derivative thereof further comprises the following chemical formula A (where X represents – O –, – S –, – SO –, – SO<sub>2</sub> –, – CH<sub>2</sub> –, – CF<sub>2</sub> –, – C(CH<sub>3</sub>)<sub>2</sub> –, – C(CF<sub>3</sub>)<sub>2</sub> – or a direct bond), and the mixing ratio thereof is in a range, in terms of mole ratio, of chemical formula A : chemical formula B = 1:9 to 5:5;



3. The polyimide precursor liquid composition according to claim 1,  
 wherein the diamine or derivative thereof is one type of  
 5 compound selected from the group consisting of the following chemical  
 formulae I and II (where Y represents  $-O-$ ,  $-S-$ ,  $-SO-$ ,  $-SO_2-$ ,  $-CH_2-$ ,  $-CF_2-$ ,  $-C(CH_3)_2-$ ,  $-C(CF_3)_2-$ ,  $-CO-$  or a direct bond);



10

4. The polyimide precursor liquid composition according to claim 1,  
 wherein the dielectric constant of the cyclic compound is not less  
 than 30.
- 15 5. The polyimide precursor liquid composition according to claim 1,  
 wherein the dipole moment of the cyclic compound is not less  
 than 3 debye.
- 20 6. The polyimide precursor liquid composition according to claim 1,  
 wherein when the solids portion of the polyimide precursor liquid  
 is 100 mass parts, the polar polymerization solvent is in the range of 150  
 to 900 mass parts, and the cyclic compound is in the range of 15 to 750  
 mass parts.

7. The polyimide precursor liquid composition according to claim 1,  
wherein the polyimide precursor is polymerized in the polar  
polymerization solvent, after which the cyclic compound is added.

5

8. (amended) A polyimide coating film that is obtained by converting a  
polyimide precursor liquid composition into an imide, the polyimide  
precursor liquid composition comprising:

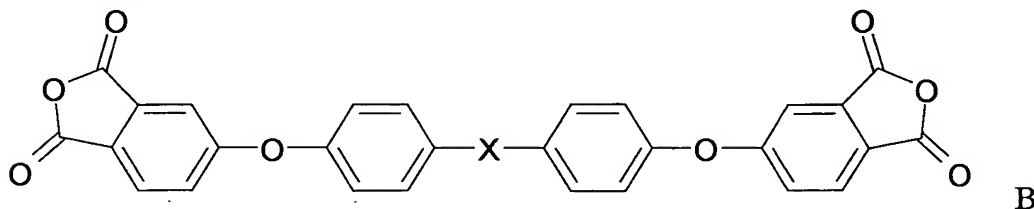
10 at least one type of tetracarboxylic dianhydride or derivative  
thereof;

at least one type of diamine or derivative thereof; and  
a polar polymerization solvent;

15 wherein the polyimide precursor liquid composition further  
includes a cyclic compound that has a 5 member ring structure that  
includes a carbonyl group (C=O bond);

wherein the cyclic compound has a boiling point of 200°C or more  
and comprises carbon, hydrogen and oxygen atoms and does not include  
hetero atoms of nitrogen, phosphorous and sulfur; and

20 wherein the tetracarboxylic dianhydride or derivative thereof  
includes a chemical formula B described below (where X represents — O —,  
— S —, — SO —, — SO<sub>2</sub> —, — CH<sub>2</sub> —, — CF<sub>2</sub> —, — C(CH<sub>3</sub>)<sub>2</sub> —, — C(CF<sub>3</sub>)<sub>2</sub> — or a  
direct bond);



25 9. The polyimide coating film according to claim 8,  
wherein when the polyimide coating film is a film or coating film  
that has a thickness of 50 ± 10 micrometers (μm) and is irradiated with

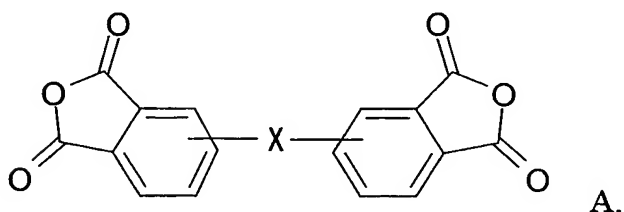
light of 420 nanometers (nm), the polyimide coating film shows a transmittance of 50% or more.

10. The polyimide coating film according to claim 8,  
5 wherein the glass transition temperature (T<sub>g</sub>) of the polyimide coating film is 200°C or more.
11. The polyimide coating film according to claim 8,  
wherein the water absorption of the polyimide coating film is  
10 2.0% or less.
12. The polyimide coating film according to claim 8,  
wherein at least a single layer of a transparent, electrically  
conductive film is further formed on at least one side of the polyimide  
15 coating film.
13. The polyimide coating film according to claim 12,  
wherein the electric resistance of the transparent, electrically  
conductive film is  $1 \times 10^{-2} \Omega \cdot \text{cm}$  or less.  
20
14. The polyimide coating film according to claim 8,  
wherein at least a single layer of a transparent film further is  
formed on at least one side of the polyimide coating film.
- 25 15. The polyimide coating film according to claim 14,  
wherein at least a single layer of a transparent, electrically  
conductive film is further formed on at least one side of the transparent  
film.
- 30 16. The polyimide coating film according to claim 15,

wherein the electric resistance of the transparent, electrically conductive film is  $1 \times 10^{-2} \Omega\cdot\text{cm}$  or less.

17. (added) The polyimide coating film according to claim 8,

- 5 wherein the tetracarboxylic dianhydride or derivative thereof further includes a chemical formula A described below (where X represents O -, - S -, - SO -, - SO<sub>2</sub> -, - CH<sub>2</sub> -, - CF<sub>2</sub> -, - C(CH<sub>3</sub>)<sub>2</sub> -, - C(CF<sub>3</sub>)<sub>2</sub> - or a direct bond), and the mixing ratio thereof is in a range, in terms of mole ratio, of chemical formula A : chemical formula B = 1:9 to
- 10 5:5;



## WRITTEN REPLY

JPO Examiner: Mr Yoshihiro Fuji

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1. Display of International Application  
PCT/JP03/16678

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4. Date of Notification 20 July 2004 (Date of Mailing)

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5. Content of Reply

Regarding the present application, we have received the PCT  
opinion as provided in accordance with Article 13 (PCT regulation 66)  
relating to, for example, international applications based on the Patent  
30 Cooperation Treaty, and we reply as follows.



(1) The invention of the present application is as described in the amendments filed at the same time.

The content of the amended claims 1, 2 and 8, and the added claim 17 is described on page 8 lines 9 to 13, page 14 lines 14 to 19 and  
5 Table 5 on page 21<sup>1</sup> of the Specification.

The Specification has also been amended so as to be consistent with the claims.

Working Examples 16 and 17 have been amended to "Reference Examples" in order to be removed from the scope of the invention.

10 The labels of "Acid anhydride" and "Diamine" in Table 5 on page 21 were swapped around, so they have been amended.

(2) All the claims of the present application have been judged to have no novelty or inventive step with respect to the cited documents.

15 However, as is asserted below, we believe that the invention of the present application has both novelty and inventive step.

(3) Explanation of the invention of the present application and the cited documents.

(3-1) Cited Document 1 (JP H6-207014A)

20 Cited Document 1 discloses that  $\gamma$ -butyrolactone is added as an organic polar solvent when synthesizing polyamic acid (paragraph number [0015]).

(3-2) Cited Document 2 (JP 2000-305280A)

25 Cited Document discloses that ethylene carbonate, propylene carbonate or the like are added to the polyamic acid in order to prevent ignition (paragraph number [0007]).

(3-3) Comparison of the present Application with the Cited Documents

Even when all the Cited Documents are combined, the passage

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<sup>1</sup> Translator's note: These correspond to page 9 lines 2 to 7, page 15 lines 16 to 20, and Table 5 on page 24.

"wherein the tetracarboxylic dianhydride or derivative thereof includes the chemical formula B described below" of claims 1 and 8 of the present application is neither described nor suggested. That is to say, the tetracarboxylic dianhydride shown in chemical formula B of the present invention is a compound characterized in that tetracarboxylic dianhydride is bonded to the ether groups on both sides of the bisphenol A. The intermolecular interactions between the polyimides can be suppressed using an acid anhydride or derivative thereof having such a high molecular weight, and transparency can be increased by retarding crystallinity.

In addition to this configuration, the present application has obtained the effect of "since compounds that have a five member ring structure that includes a carbonyl group (C=O bond) have a larger dipole moment and dielectric constant than polar organic solvents that are generally used for polymerizing polyamic acid, and that these compounds strongly solvate with polyamic acid due to the planar structure of the original five member ring, these compounds are substituted for the polar organic solvent when they are used, and there is an effect of preventing discoloration when firing at high temperatures." (page 5 lines 8 to 12<sup>2</sup> of the Specification) by adding "that has a 5 member ring structure that includes a carbonyl group (C=O bond), wherein the cyclic compound has a boiling point of 200°C or more and comprises carbon, hydrogen and oxygen atoms and does not include hetero atoms of nitrogen, phosphorous and sulfur."

Such characteristic actions and effects could not be predicted from the cited documents even by one skilled in the art.

More specifically, the upper row of page 5 of Cited Document 1 discloses the L, a and b values of the film of Working Examples 1 to 4,

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<sup>2</sup> Corresponds to page 6 lines 2 to 10 of the English translation.

wherein  $L = 22$  to  $32$ ,  $a = 18$  to  $19$  and  $b = 14$  to  $21$ .

For the Working Examples 1 to 15 of the present invention, when a spectrum color difference meter (Suga Testing Instruments SC-T) is similarly used to measure the  $L$ ,  $a$  and  $b$  values, resulting in  $L$  being 90 to 92,  $a$  being 0 to 1 and  $b$  being 3 to 5. These are significantly different.

Such characteristic actions and effects could not be predicted from the cited documents even by one skilled in the art.

(4) Summary

As described above, the invention of the present application is configured such that it includes characteristic acid components that are neither disclosed nor suggested in the Cited Documents, and because the significance of the effect is clearly due to these differences, we believe that the invention has both novelty and inventive step.

15

6. Index of attached documents

(1) Written Amendments 1 copy